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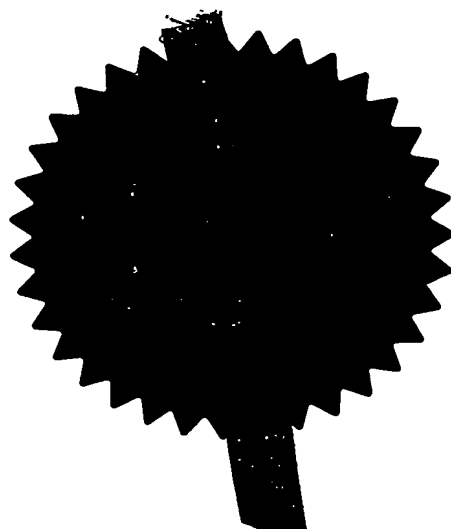
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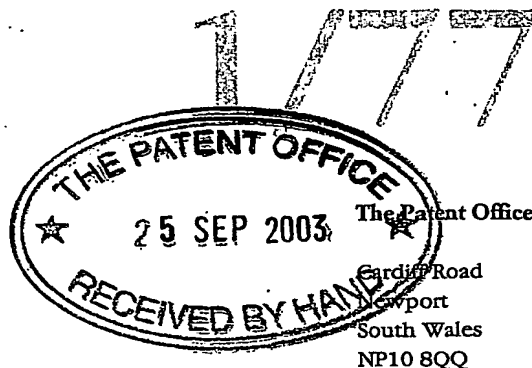
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Stephen Hordley

Dated

9 September 2004





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2. Patent application number (The Patent Office will fill this part in)		0322485.4	26SEP03 E839966-7 002882 P01/7700-0.00-0322485.4
3. Full name, address and postcode of the or of each applicant (underline all surnames)		DISPERSE LIMITED Surrey Research Park 40 Alan Turing Road Guildford, Surrey, GU2 7YF	
Patents ADP number (if you know it)		8047219002	
If the applicant is a corporate body, give the country/state of its incorporation		United Kingdom	
4. Title of the invention		PROCESS FOR THE PREPARATION OF SURFACE COATINGS OR DRY FILMS	
5. Name of your agent (if you have one)		BOULT WADE TENNANT	
"Address for service" in the United Kingdom to which all correspondence should be sent (including the postcode)		VERULAM GARDENS 70 GRAY'S INN ROAD LONDON WC1X 8BT	
Patents ADP number (if you know it)		42001 ✓	
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Abstract

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PROCESS FOR THE PREPARATION OF SURFACE COATINGS
OR DRY FILMS

The present invention relates to a process for the
5 preparation of surface coatings or dry films in which one or
more oils or oil-soluble substances are encapsulated as
discrete oil droplets within the surface coating or film.

The entrapment of oils or oil soluble substances
(especially perfumes and coloured dye precursors) in
10 microcapsules and their subsequent coating onto paper and
other surfaces is well known in the art. Microcapsules of
this type comprise individual droplets of oil or oil soluble
substances (of size ranging from sub-micrometre to tens of
millimetres in diameter) around which polymer walls have
15 been formed by one of a number of chemical processes.
Usually such microcapsules are prepared as an aqueous
suspension which is then capable, with the addition of
suitable modifying reagents, of being sprayed or printed
onto paper and other surfaces. The object in so doing is
20 usually to prevent the evaporation of volatile substances
(for example, perfumes) or the degradation or chemical
reaction of oil soluble species (for example, colourless dye
precursors) until the microcapsules are broken by the
application of shear forces by scratching or scraping the
25 coated surface with the consequent release of their
contents. Such coatings find major uses, for example, in
the forms of "scratch and sniff" perfume coatings or NCR (No
Carbon Required) paper.

However, such coatings and the use of microcapsules
30 which form them suffer from a number of disadvantages.

Firstly, the process by which microcapsules are formed
is a lengthy and uncertain one in which control over

temperature, pH and the absence of any form of contamination is essential. The formation of microcapsules, for example, by complex coacervation from gelatine and an anionic complexing species such as gum acacia takes many hours and demands very close control of pH, temperature and cooling rate. Similarly, the formation of microcapsule walls from aminoplast resins, such as melaminformaldehyde or urea-formaldehyde takes at least eight hours during which precise control over all controllable parameters needs to be effected. Moreover, the effectiveness and completeness of any individual encapsulation process, and therefore the quality of the microcapsules so formed, depends largely upon the chemical nature of the oil and/or oil soluble substances being encapsulated.

A further disadvantage of microencapsulation is that the thickness and therefore the strength of the microcapsule wall is variable and is not easily controllable and varies with the nature of the oil or oil-soluble substances being encapsulated. Thus microcapsules made by the same process, but from different oils, may have widely differing strengths and resistance to breakage during the printing process and during subsequent storage and use.

A yet further disadvantage of microencapsulation is the limited number of chemical processes and the limited number and type of polymeric wall materials which are available to form them. The choice as to the properties of the wall materials is consequently limited with regard to their flexibility, tensile strength, permeability, chemical inertness, mammalian toxicity and other properties including solubility and melting point (if any). In addition, some of the chemicals commonly used in the wall forming process are themselves highly irritating and may themselves be toxic

such, for example, as the use or release of formaldehyde (a potential carcinogen) during the manufacture of aminoplast resin walls. Moreover, the remaining traces of formalin in the resulting microcapsule suspension are virtually impossible to eliminate to below acceptable levels for uses of microcapsules and requires special precautions to be taken during the manufacturing process.

A further disadvantage of microcapsules which are used in surface coatings is that the microcapsule walls have a limited deformability, that is, they can only be deformed to a limited extent during the surface coating process (typically a printing process) before they will rupture and prematurely release their contents. The extent of their ability to deform when squeezed, for example, between nip rollers on a printing press set with a gap smaller than the average diameter of the microcapsules, depends partly upon the tensile properties of the polymer wall, its thickness and on the size of the microcapsules being squeezed.

Other methods for coating paper and other surfaces with mobile oils are known, but these are generally inferior to coating with microcapsules since they do not effectively trap and protect the oils from evaporation or degradation during manufacture and subsequent storage prior to use. For example, perfumes may be sprayed or otherwise coated with paper surfaces in order to give paper products a pleasant smell - as for instance, with perfumed drawer liners wherein the coating is sprayed on perfume and not a microcapsuled perfume. Such products have a limited shelf life (because of the premature evaporation of the perfume) and the outer packaging of the product is usually the only (and relatively ineffective) barrier to loss of perfume of other volatile substances during storage.

WO 02/051536 describes a process for the encapsulation of an emulsion in which a water-in-oil or an oil-in-water emulsion is prepared from a polymerisable emulsifier, at least one polyfunctional comonomer, at least one hydrophilic liquid and at least one hydrophobic liquid. The mixture is polymerised by means of UV curing and/or initiators during which polymerisation the polymerisable emulsifier and the polyfunctional comonomer react together to form a matrix which entraps the emulsion in microcapsules having a particle size of from 70nm to 5µm.

WO 99/05329 describes a method of coating the surface of a substrate in which the surface is contacted with a dispersion of a film forming polymer, the dispersion containing droplets of a biliquid foam or of an emulsion, and allowing the dispersion to dry so as to coat the surface with a coating comprising the droplets trapped within a film of the polymer. This process suffers from the disadvantage that if the film forming polymer suspensions are aqueous, the drying of the dispersion requires a long period of time at room temperature or the application of heat. If the film forming polymer dispersions contain high levels of more volatile polar solvents, then appropriate measures are then needed to prevent emissions into the environment in the drying process.

We have now developed a process for the preparation of dry films or coatings which encapsulate droplets of a biliquid foam or of a high internal phase oil-in-water emulsion therein, which does not suffer from the disadvantages of the process of WO 99/05329.

Accordingly, the present invention provides a method of coating the surface of a substrate which comprises the steps of:

- i) contacting the surface with a polymerisable mixture comprising one or more polymerisable components and containing suspended droplets of a biliquid foam or of a high internal oil phase emulsion, the said droplets being stabilised by a non-reactive surfactant; and
- ii) polymerising the coating to form a film of a polymer comprising the droplets entrapped therein.

Using the method of the present invention a surface coating is obtained which comprises a polymer film in which the droplets of the biliquid foam or a high internal oil phase emulsion are entrapped. These systems are preferred since they contain low levels of water.

Preferably a biliquid foam is used. Biliquid foams are known in the art in which small droplets of a predominantly non-polar liquid such as an oil are encapsulated in a surfactant-stabilized film of a hydrogen bonded liquid, such as water, and separated from one another by a thin film of the hydrogen bonded liquid. The water or other hydrogen bonded liquid thus forms the continuous phase in biliquid foam compositions.

Biliquid foams are disclosed in the following literature references by Sebba:

"Biliquid Foams", J. Colloid and Interface Science, 40 (1972) 468-474; and "The Behaviour of Minute Oil Droplets Encapsulated in a Water Film", Colloid Polymer Sciences, 257 (1979) 392-396.

The biliquid foam or high internal oil phase emulsion used in the present invention will generally comprise at least 70 percent by weight of the oil phase, preferably greater than 85 percent by weight and more preferably

greater than 90 percent by weight of the oil phase. The external phase is polar and may consist of water or water in admixture with other polar solvents such as C₁₋₄ alcohols or organic oxygenates. The external phase may also comprise
5 one or more polymerisable components, such as N-vinyl pyrrolidone.

The polymerisable mixture will generally comprise from 1 to 50 percent by weight of the biliquid foam or high internal oil phase emulsion, preferably from 20 to 40
10 percent by weight thereof.

The biliquid foam or high internal oil phase emulsion is stabilized in the present invention by a non-reactive surfactant. By the term "non-reactive surfactant" as used herein we mean a surfactant which does not polymerise with,
15 or react with, the polymerisable components of the polymerisable mixture. Accordingly, on polymerising the polymerisable mixture the formation of discrete microcapsulates will be avoided.

In carrying out the process of the present invention
20 the polymerisable components within the coating are polymerized to form a polymer film within which the oil containing droplets are entrapped.

Polymerisation is generally defined as the formation of a polymer chain by the linking of repetitive monomer or
25 oligomer subunits. Monomers are low molecular weight components that have a degree of unsaturation (carbon double bonds). They may be mono- or polyunsaturated. Oligomers (or pre-polymers) are larger molecular entities and are usually bifunctional. The final characteristics of the polymer can
30 be manipulated by blending monomers/oligomers of different chemical nature and varying degrees of unsaturation.

There are three main types of polymerisation, namely, free radical, cationic and anionic polymerisation.

Free radical polymerisation relies upon the generation of radical species which have unpaired electrons and are highly reactive. The formation of these highly excited radical states requires the input of additional energy from an outside source. Electron beam radiation causes the formation of radical species directly within the system by bombarding the monomers with electrons to disrupt the double bonds causing the formation of the radicals. Electron beam is however energy intensive and so it is more common to use a photoinitiator in the system. A photoinitiator is a molecule that strongly absorbs light energy usually in the UV spectra causing it to either self cleave (homolytic scission) or to donate the energy onto a co-initiator to produce the radicals.

Cationic polymerisation is similar to free radical polymerisation but instead of a free radical being the reactive species the photoinitiator releases a strong Lewis acid or Bronsted acid. These acids subsequently initiate the polymerisation.

Anionic polymerisation is also similar to free radical polymerization but the reactive species in this instance is a base which initiates the polymerisation.

Monomers/oligomers which may be used in free radical polymerization process will generally contain one or more vinyl groups. Suitable vinyl monomers include, for example, monoalkenyl arene monomers such as styrene α -methacrylate, chloromethylstyrene, vinyl ethylbenzene and vinyl toluene; acrylate or methacrylate esters such as 2-ethylhexyl acrylate, n-butyl acrylate, isobutyl acrylate, t-butyl acrylate, hexyl acrylate, n-butyl methacrylate, lauryl

methacrylate, isodecyl methacrylate, propoxylated neopentyl glycol diacrylate, melamine pentacrylate, polyethylene glycol diacrylate, trimethylpropane diacrylate, 1,6-hexanediol diacrylate, bisphenol A ethoxylate diacrylate, 2-phenoxyethyl acrylate, tripropylene glycol diacrylate, ethoxylated or propoxylated trimethylolpropane triacrylate, dipropylene glycol diacrylate, diethylene glycol diacrylate, tetrahydrofurfuryl acrylate, n-vinyl caprolactam or N-vinyl pyrrolidone, dipentaerythritol monohydroxy pentacrylate, dipentaerythritol hexacrylate, conjugated diolefins such as butadiene, isoprene, and piperylene, allenes such as allene, methyl allene and chloroallene; olefin halides such as vinyl chloride, vinyl fluoride and polyfluoroolefins; unsaturated polyesters; vinyl siloxanes; vinyl ether/unsaturated ester systems such as maleates, fumarates or citraconates; N-vinylformamide; N-(n-hexyl)maleimide; N-arylimides; N-allylimides and N-arylmaleimides, or mixtures thereof. Oligomers which may be used in the free radical polymerisation process include aliphatic urethane acrylate oligomers and aliphatic polyester/ether urethane acrylate mixtures.

Monomers/oligomers which may be used in cationic polymerisation processes include epoxides, such as cycloaliphatic epoxides; glycidyl ethers; propenyl ethers; 2- and 4-alkoxy styrene and polyfunctional vinyl ethers such as aliphatic polyurethane vinyl ethers, polyethyl divinyl ethers and aromatic polyurethane vinyl ethers, or mixtures thereof. Typical initiators for these systems are often referred to as latent acid initiators. These include diazonium salts with non-nucleophilic counterions such as tetrafluoroborate, hexafluorophosphate, hexafluoroarsenate and hexafluoroantimonate; diaryliodonium and triarylsulphonium salts; and pyrilium, thiopyrilium and N-

alkoxypyridinium compounds all bearing non-nucleophilic counterions. Sensitisers may be included in addition to these salts to extend the spectral sensitivity of onium salts. These sensitizers include anthracene, perylene, phenothiazine, Michler's ketone, xanthone, thioxanthone, benzophenone and acetophenone.

Monomers/oligomers which may be used in anionic polymerisation processes include epoxides, multifunctional acrylates and alpha-cyanoacrylates. Examples also include the Michael addition reaction of a malonate polyester with a multifunctional acrylate.

Initiators for the anionic polymerisation reaction include tertiary amine salts of alpha-ketocarboxylic acids, suitably substituted carbamates (urethanes), phenylammonium n-butyltriphenyl borate salts, ferrocenes and metal amine salts.

The preferred approach in this invention is the use of radical polymerisation. Cationic initiation may be very slow, especially in the presence of moisture, whilst anionic initiation suffers from the lack of commercial initiator systems.

Hybrid polymerization processes may also be used in which mixture of, for example, blocked isocyanates, acrylate diluents and epoxide prepolymers, vinyl ether diluents and acrylate prepolymers or acrylate diluents and vinyl ether prepolymers may be used.

Radical polymerisation initiators which may be used in the present invention may be water soluble or oil soluble. Water soluble initiators which may be used include, for example, potassium persulphate or sodium persulphate and various redox systems such as ammonium bisulphate together with sodium metabisulfate. Oil soluble initiators which may

be used include, for example, azo compounds such as α,α -azo-bisbutyronitrile and peroxides such as benzoyl peroxide, methylethylketone peroxide, di-2-ethylhexylperoxydicarbonate and lauroyl peroxide. Other initiators which may be used

5 include zinc carbonate, 1-hydroxy-cyclohexyl-phenylketone, 2-hydroxy-2-methyl-1-phenyl-1-propanone, 2-hydroxy-1-[4-(2-hydroxyethoxy)phenyl]-2-methyl-1-propanone methylbenzoxyl formamate, 2-benzyl-2(dimethylamino)-1-[4-[4-morpholinyl)-phenyl]-1-butanone, 2-methyl-1-[4-(methylthio)phenyl]-2-(4-

10 morpholinyl)phenyl-1-butanone, benzoin methyl ether, benzoin ethyl ether, α,α -diethoxyacetophenone, α,α -diethoxy- α -phenyl-acetophenone, 4,4'-bis(dimethyl-amino)benzophenone, ferrocene, xanthone, thioxanthone, 1-chloro-4-propoxy-thioxanthane, diphenyl(2,4,6-trimethylbenzoyl)-phosphine

15 oxide, bis(eta 5-2,4-cyclopentadien-1-yl)bis[2,6-difluoro-3-(1H-pyrrol-1-yl)phenyl]titanium, iodonium(4-methyl-phenyl)[4-(2-methylpropyl)phenyl]-hexafluorophosphate-(1-), decabromodiphenyl oxide, pentachlorobenzene, pentabromomono-chloro cyclohexane, 2-ethyl anthraquinone, 1-

20 (chloroethyl)-naphthalene, desyl chloride, chlorendic anhydride, naphthalene sulphonic chloride and 2-bromoethyl ethyl ester.

The initiator will generally be added to the monomer or oligomer. Combinations of initiators may also be used. The

25 initiator may be present in an amount of from 0.005 to 20 percent by weight, preferably from 0.1 to 20 percent by weight, more preferably from 0.1 to 5 percent by weight of the composition and still more, preferably from 1 to 4 percent by weight of the composition.

30 The polymerisable mixture which is coated onto a substrate in the process of the present invention is

preferably polymerised by electron beam or UV radiation curing.

Further additives which may be used in the coating compositions include chain transfer agents, such as tertiary
5 alcohol amines, triethanol amine, N-methyl diethanolamine, N,N-dimethylethanolamine or substituted morpholines such as N-methylmorpholine. Other additives which may be used are adhesion promoters, wetting agents, slip agents,
10 preservatives, dyes, inorganics (for example pigments, silicas, clays, etc.) photo-sensitisers, waxes (can be used to prevent/reduce oxygen inhibition of polymerisation), unreactive preformed polymers and rheology modifying agents.

The present invention includes within its scope a surface coating prepared according to the above described
15 method in which droplets of a biliquid foam or a high internal oil phase emulsion are entrapped within a polymer film.

The polymer film may be selected so that the oil phase is releasable from the coating upon the application of shear
20 forces to the polymer film. In the instance where the substance is, or contains, a perfume, a "scratch and sniff" coating is produced.

The polymer film may be selected so that the oil is releasable from the coating by the action of a chemical
25 release agent on the polymer. The oil may be released at a determined pH, or by contact of the polymer film with water, or other predetermined solvent.

The polymer film may be selected so that the non-polar substance is released from the coating by the application of
30 heat to the polymer.

The polymer film may be partially or wholly crosslinked.

It should be noted that all of these release mechanisms are difficult or impossible to achieve with prior art technology because of the limited choice of wall materials from which microcapsules can be made as noted above.

5 Methods and coatings in accordance with the invention will now be described with reference to the accompanying drawings in which:-

Figure 1 shows a biliquid foam in a dispersion of a polymerisable mixture applied to a surface; and

10 Figure 2 shows a surface coating after polymerisation of the polymerisable mixture of Figure 1.

Figures 1 and 2 illustrate a method for coating the surface 3 of a substrate comprising the steps of:

15 contacting the surface 3 with a polymerisable mixture 1, the mixture 1 containing droplets 2 of a suspended biliquid foam or high internal oil phase emulsion; and

polymerising the mixture 1 so as to coat the surface with a coating comprising the droplets 5 trapped within a film 4 of said polymer.

20 The polymer film thus becomes a surface coating containing a plurality of suspended but intact oil droplets protected by the polymer film and depending for their integrity, strength, ease and method of rupture, chemical inertness and permeability on the structure, thickness and
25 nature of the polymeric material.

It is preferable to use a biliquid foam, although the use of high internal oil phase emulsions is within the scope of the invention.

30 Figures 1 and 2 indicate diagrammatically the microscopic structure and appearance of a biliquid foam entrapped in a polymerisable mixture coated onto a surface before polymerisation (Figure 1) and after polymerisation

(Figure 2). In Figure 1, the polymerisable mixture 1 is coated onto a suitable surface 3. Droplets of biliquid foam 2 are trapped in the surface. These are typically 1 to 10 micrometres in diameter. Figure 2 indicates the appearance of the polymerised film 4. The thickness of this film 4 will be similar to that of the uncured coating. The biliquid foam droplets 5 can be seen to be somewhat flattened (to an extent dependent upon the film thickness) but intact, with a surface covering of polymer film 4.

It is possible to make biliquid foams comprising mainly natural oils (for example, soya bean oil and sunflower oil), kerosenes, mineral oils, perfumes, organic solvents (for example, hexane, cyclohexane, chloroform, carbon tetrachloride and the like), silicone oils and their derivatives (such as dimethicones and cyclomethicones), fatty alcohols and their derivatives (for example isopropyl palmitate, isopropyl myristate) and most other non water-soluble liquids. The present invention may utilise any or all of the above singly or in combination or any other oil or non polar substances capable of existing in liquid form in the temperature range -50°C to 200°C but typically 3°C to 90°C and preferably 10°C to 30°C .

The present invention provides a means of controlling the rate of release of the entrapped oil by exercising control over the concentration of the polymerisable component(s) in solution or suspension and thereby controlling the thickness and strength of the film deposited.

The present invention also includes within its scope a stand alone polymer film which is obtained by removing the surface coating prepared in the manner as hereinbefore described from the substrate on which it is formed.

The present invention will be further described with reference to the following Examples.

EXAMPLE 1

5 Preparation 1

A biliquid foam was prepared from the following ingredients.

	Ingredients	%
	Aqueous phase	
10	Water	9.895
	Sodium lauryl ether sulphate	0.10
	Kathon CG	0.005
	Oil phase	
	Medium liquid white oil	89.1
15	Volpo V4	<u>0.9</u>
		<u>100.00</u>

The biliquid foam was prepared by adding the oil phase to the aqueous phase and stirring with a paddle stirrer at 20 200rpm initially, increasing to 600rpm.

Formulation 1

	Ingredients	Weight (g)	%
	Preparation 1	0.55	18.77
25	Ebecryl 2001 (UCB)	2.0	68.26
	Water	0.28	9.95
	Darocur 4265 (Ciba)		
	photoinitiator	<u>0.10</u>	<u>3.42</u>
	Total	<u>3.93</u>	<u>100.00</u>

30

The ingredients were mixed together, with preparation 1 being added last. The formulation was then applied as a 100

micrometre thick coating to a substrate using a calibrated slot film applicator. The sample was then cured, using a GEW bench UV curing system with power level of 100 W/cm and conveyor speed of 0.1 m/second, with several passes under the UV lamp to ensure through cure.

EXAMPLE 2

Preparation 2

A biliquid foam was prepared from the following ingredients.

Ingredients	%
Aqueous phase	
Water	9.895
Sodium lauryl ether sulphate	0.1
Kathon CG	0.005
Oil phase	
Mineral oil	89.1
Volpo L3	<u>0.9</u>
Total	<u><u>100.00</u></u>

The biliquid foam was prepared by adding the oil phase to the aqueous phase and stirring using a paddle stirrer at an initial speed of 110 rising to 525rpm, until an average particle size of 9 μ m was achieved.

Formulation 2

	Ingredients	Weight (g)	%
	Preparation 2	0.27	20.45
	Aliphatic urethane	0.668	50.61
5	diacrylate CN 981		
	Cray Valley		
	Poly[oxy(methyl-1,2-	0.332	25.15
	ethanediyl)]Actilane		
	421 (Akzo Nobel)		
10	Darocur 1173 (Ciba)	<u>0.05</u>	<u>3.79</u>
	photoinitiator		
	Total	<u>1.32</u>	<u>100.00</u>

The ingredients were mixed together, with preparation 2
15 being added last. The formulation was then applied as a 100
micrometre thick coating to a substrate using a calibrated
slot film applicator. The sample was then cured, using a GEW
bench UV curing system with power level of 100 W/cm and
conveyor speed of 0.1 m/second, with several passes under
20 the UV lamp to ensure through cure.

EXAMPLE 3

Preparation 3

A biliquid foam was prepared from the following
5 ingredients.

	Ingredients	%
	Aqueous phase	
	Demineralised Water	9.9%
	Tween 20	0.1%
10	Oil phase	
	Fragrance	89.1%
	Castor oil/polyethylene glycol (25) additive	0.9%

The oil phase was added dropwise to the aqueous phase,
15 which was stirred by a propeller impeller at 200 rpm. The product was left stirring for a further 15 minutes after the addition of the oil was complete.

Preparation of Monomer Mixture A

		%
20	Craynor CN9761	76.35%
	Sartomer monomer SR489	23.64%

The two monomers were added together and stirred to
25 give a homogenous mixture.

Formulation 3

	Ingredients	%
30	Monomer Mixture A	74.8
	Preparation 3	21.3
	Darocur 1173 initiator	3.9

The ingredients of the formulation were added sequentially in the order given above with stirring to ensure a homogeneous mixture.

5 The formulation was then applied as a 100 micrometre thick coating to a substrate using a calibrated slot film applicator. The sample was then cured, using a GEW bench UV curing system with power level of 100 W/cm and conveyor speed of 0.1 m/second, with several passes under the UV lamp
10 to ensure through cure.

EXAMPLE 4

Preparation 4

15 A biliquid foam was prepared from the following ingredients:

	Ingredients	%
	Aqueous phase	
	Demineralsed Water	9.9%
20	Sodium lauryl ether sulphate	0.1%
	Oil phase	
	Mineral oil	89.1%
	Laureth 4	0.9%

25 The oil phase was added dropwise to the aqueous phase at first. The aqueous phase was stirred using a large paddle stirrer at 110rpm. After 5 minutes of the dropwise addition of the oil phase, the stirrer speed was maintained at 110rpm but the oil phase was then added in a steady stream. When the addition of the oil phase was complete the
30 product was stirred for a further 15 minutes. The product was then further sheared down at 600rpm to decrease the droplet size.

Preparation of Monomer Mixture B

		%
	Ebecryl 2001	48.7
5	Darocur 1173	4.5
	Ebecryl 2002	30.1
	Photomer 4399	10.6
	Demineralised water	6.1

- 10 The monomers and water were added sequentially in the order given above, each time with stirring to give a homogeneous mixture.

Formulation 4

		%
15	Monomer mixture B	77
	Preparation 4	19.2
	Microflex-1(wetting agent)	3.8

- 20 The ingredients of the formulation were added sequentially in the order given above with stirring to ensure a homogeneous mixture.

- 25 The formulation was then applied as a 100 micrometre thick coating to a substrate using a calibrated slot film applicator. The sample was then cured, using a GEW bench UV curing system with power level of 100 W/cm and conveyor speed of 0.1 m/second, with several passes under the UV lamp to ensure through cure.

Footnote to the Examples

<u>Trade Name</u>	<u>Chemical Name</u>
Kathon CG	- Preservative - Mixture of: 5-chloro 2-methyl-4-isothiazolin-3-one and 2-methyl-4-isothiazolin-3-one
Volpo L3	- C ₁₂₋₁₃ Pareth-3
Volpo L4	- C ₁₂₋₁₃ Pareth-4
Ebecryl 2001	- aliphatic urethane diacrylate
Ebecryl 2002	- polyurethane acrylate/tri-propylene glycol diacrylate
Darocur 1173	- 2-hydroxy-2-methyl-1-phenyl-1-propanone
Darocur 4265	- 2-hydroxy-2-methyl-1-phenyl-1-propanone/diphenyl (2,4,6-trimethylbenzoyl)-phosphine oxide
Photomer 4399	- dipentaerythritol monohydroxy-pentacrylate
Tween 20	- Polysorbate 20
Craynor CN9761	- aromatic urethane acrylate
Sartomer monomer SR489	- tridecyl acrylate

CLAIMS:

1. A method of coating the surface of a substrate which comprises the steps of:

- 5 i) contacting the surface with a polymerisable mixture comprising one or more polymerisable components and containing suspended droplets of a biliquid foam or of a high internal oil phase emulsion, the said droplets being
10 stabilised by a non-reactive surfactant; and
 ii) polymerising the coating to form a film of a polymer comprising the droplets entrapped therein.

15 2. A method as claimed in claim 1 wherein a biliquid foam is used.

 3. A method as claimed in claim 1 wherein a high internal oil phase emulsion is used which comprises at least
20 70 percent by weight of the oil phase.

 4. A method as claimed in claim 1 wherein the high internal oil phase emulsion comprises at least 90 percent by weight of the oil phase.

25 5. A method as claimed in any one of the preceding claims wherein the polymerisable mixture comprises from 1 to 50 percent by weight of the biliquid foam or high internal oil phase emulsion.

30 6. A method as claimed in claim 5 wherein the polymerisable mixture comprises from 20 to 40 percent by

weight of the biliquid foam or high internal oil phase emulsion.

7. A method as claimed in any one of the preceding
5 claims wherein the coating is polymerised using electron beam or UV radiation curing.

8. A method as claimed in any one of the preceding
10 claims wherein the external phase of the biliquid foam or high internal oil phase emulsion comprises water or mixture of water with a polar solvent.

9. A method as claimed in claim 8 wherein the
15 external phase comprises a mixture of water and a C₁₋₄ alcohol or organic oxygenate.

10. A surface coating prepared according to any one of
the preceding claims which comprises droplets of a biliquid foam or high internal oil phase emulsion entrapped within a
20 polymer film.

11. A surface coating as claimed in claim 10 in which
the polymer film is selected so that the oil phase of the biliquid foam or high internal oil phase emulsion is
25 releasable from the coating upon the application of shear force to the polymer film.

12. A surface coating as claimed in claim 10 in which
the polymer film is selected so that the oil is releasable
30 from the coating by the action of a chemical release agent on the polymer.

13. A surface coating as claimed in claim 12 in which the oil is released at a predetermined pH.

14. A surface coating as claimed in claim 12 in which
5 the oil is releasable by contact of the polymer film with water, or other predetermined solvent.

15. A surface coating as claimed in claim 10 in which the polymer film is selected so that the oil is releasable
10 from the coating by the application of heat to the polymer.

16. A surface coating as claimed in any one of claims 10 to 15 in which the polymer film is partially or wholly crosslinked.

15

17. A stand alone polymer film which is obtained by removing the surface coating as claimed in any one of claims 10 to 16 from the substrate on which it is formed.

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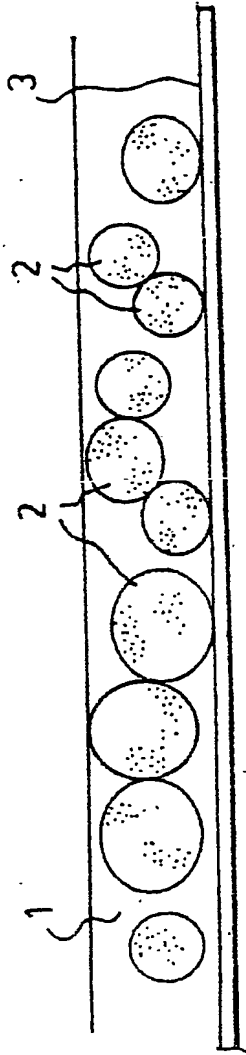


FIG. 1

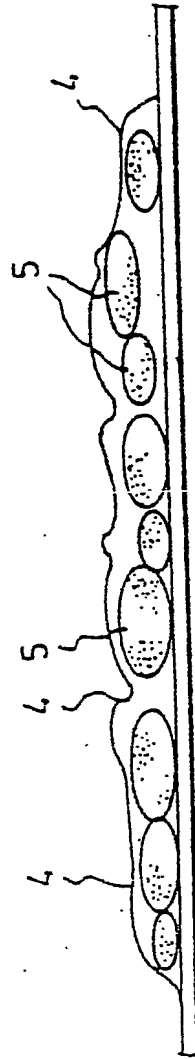


FIG. 2

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